What is claimed is:

1.      A method of forming a wireless data communication network among transceivers, each transceiver including a designation with a first plurality of transceivers having a first common designation and a second plurality of transceivers having a second common

5       designation different from the first common designation, the method comprising the steps of:

(a)     forming an *ad hoc* hierarchical network for each of the first plurality and second plurality of transceivers; and

(b)     communicating to an external network from each transceiver of each *ad hoc*

10      hierarchical network by,

(i)     establishing a communication link between each transceiver in a level of the *ad hoc* hierarchical network, other than the highest level, with a transceiver in the next higher level of the *ad hoc* hierarchical network such that transceivers pass communications upward in the *ad hoc*

15      hierarchical network; and

(ii)    establishing a communication link between a transceiver in the highest level of the *ad hoc* hierarchical network and an external network access transceiver, such that communications from transceivers in the *ad hoc* hierarchical network are passed through the transceiver in the highest

20      level of the *ad hoc* hierarchical network to the external network access transceiver.

2.      A method of forming a wireless data communication network among transceivers in an asset-tracking system, each transceiver including a class designation with a first plurality of transceivers having a first class designation and a second plurality of

25      transceivers having a second class designation different from the first class designation, the method comprising the steps of:

(a)     forming an *ad hoc* hierarchical class based network for each of the first plurality and second plurality of transceivers; and

(b)     communicating to an external network from each transceiver of each *ad hoc*

30      hierarchical class based network by,

(i)     establishing a communication link between each transceiver in a level of the *ad hoc* hierarchical class based network, other than the highest level, with a transceiver in the next higher level of the *ad hoc* hierarchical class based network such that transceivers pass communications upward in the

35      *ad hoc* hierarchical class based network; and

(ii)    establishing a communication link between a transceiver in the highest level of the *ad hoc* hierarchical class based network and an external network access transceiver, such that communications from transceivers in the *ad hoc* hierarchical class based network are passed through the

transceiver in the highest level of the *ad hoc* hierarchical class based network to the external network access transceiver.

3.    The method of claim 2, wherein said step of forming an *ad hoc* hierarchical class based network for each of the first plurality and second plurality of transceivers comprises the steps of:

(a)    filtering, by each transceiver, transmissions from other transceivers for an identification of its class designation within the transmission;

(b)    transmitting, from a primary transceiver of the first plurality, a primary availability signal including an identification of the first class designation and an identification of the primary transceiver transmitting the primary availability signal;

(c)    transmitting, from a primary transceiver of the second plurality, a primary availability signal including an identification of the second class designation and an identification of the primary transceiver of the second plurality transmitting the primary availability signal;

(d)    transmitting, from a transceiver receiving a primary availability signal having an identification therein of its class designation, a registration signal including an identification of the class designation and an identification of the transceiver transmitting the registration signal;

(e)    identifying a transceiver transmitting a registration signal as a secondary transceiver by a primary transceiver of the same class designation, the primary transceiver thereby assuming a higher level in the *ad hoc* hierarchical class based network relative to the said identified secondary transceiver such that communication from the secondary transceiver to the external network is passed to the primary transceiver.

4.    The method of claim 3, further comprising the step of identifying a transceiver transmitting a registration signal as a newly promoted primary transceiver by a primary transceiver of the same class designation when the communication channel capacity of the primary transceiver is reached, the primary transceiver thereby assuming a lower level in the *ad hoc* hierarchical class based network relative to the said identified newly promoted primary transceiver such that communication from the primary transceiver to the external network is passed to the newly promoted primary transceiver and such that communication to the external network from any secondary receivers of the primary transceiver is passed through the primary transceiver to the newly promoted primary transceiver.

5.    The method of claim 4, wherein said step of forming an *ad hoc* hierarchical class based network comprises forming a *ad hoc* hierarchical class based network in a bottom-up manner.

6.  The method of claim 3, further comprising the step of identifying, by a primary transceiver when the communication channel capacity of the primary transceiver is reached, a secondary transceiver thereof as a new primary transceiver of the next lower level of the *ad hoc* hierarchical class based network; the new primary transceiver then transmitting a primary availability signal including an identification of its class designation and an identification of itself for identifying secondary receivers relative thereto, whereby communication to the external network from any secondary transceivers relative to the new primary transceiver is passed to new primary transceiver and then passed to the primary transceiver in the next higher level of the *ad hoc* hierarchical class based network.

7.  The method of claim 6, wherein said step of forming an *ad hoc* hierarchical class based network comprises forming a *ad hoc* hierarchical class based network in a top-down manner.

8.  The method of claim 2, wherein the primary transceivers of the highest levels of the *ad hoc* hierarchical class based networks are located within a broadcast area of the external network access transceiver.

9.  The method of claim 8, wherein other transceivers of the *ad hoc* hierarchical class based networks are not located within a broadcast area of the external network access transceiver.

10. The method of claim 2, wherein a communication from the external network is broadcast by the external network access transceiver to all transceivers within the broadcast area of the external network access transceiver.

11. The method of claim 10, wherein the communication includes an identification of a class designation and only those transceivers having a matching class designation receive and process the communication from the external network access transceiver.

12. The method of claim 2, wherein a communication from the external network is broadcast by the external network access transceiver to a transceiver in the highest level of each *ad hoc* hierarchical class based network and not to all transceivers within the broadcast area of the external network access transceiver.

13. The method of claim 12 wherein each transceiver in the highest level of each *ad hoc* hierarchical class based network retransmits the communication from the external network access transceiver to other transceivers in its *ad hoc* hierarchical class based network.

14. The method of claim 12 wherein the external network access transceiver transmits the communication at a reduced power level.

15. The method of claim 12 wherein the external network access transceiver transmits the broadcast at a reduced power level.

16.  The method of claim 12 wherein the transceivers in the highest level of the *ad hoc* hierarchical class based networks represent the physically closest transceiver to the external network access transceiver for its respective class designation.

17.  The method of claim 12, wherein the communication includes an identification of transceivers in the highest level of the *ad hoc* hierarchical class based networks.

18.  The method of claim 2, wherein the transceivers are used to track assets.

19.  The method of claim 18, wherein the transceivers of the first and second pluralities are used to communicate with the transceivers attached to the tracked assets.

20.  The method of claim 19, wherein the transceivers attached to the tracked assets comprise transponders.

21.  The method of claim 19, wherein the transceivers attached to the tracked assets are semi-passive and the each of the first plurality and second plurality of transceivers are active.

22.  The method of claim 19, further comprising the step of assigning a class designation to each plurality of transceivers based on a common characteristic or behavior of the assets associated with the transponders when read by each of the plurality of transceivers.

23.  An *ad hoc* class based network formed in accordance with the step of the method of claim 2.

24.  The wireless data communication network formed by the method of claim 2.

25.  The wireless data communication network of claim 24, wherein said wireless data communication network comprises a distributed hierarchical database for tracking assets.

26.  Computer readable-medium having computer-executable instructions for performing the *ad hoc* class based network formation steps recited in claim 3.

27.  A transceiver including the computer-readable medium recited in claim 26.

28.  A method for communicating to a recipient transceiver from a plurality of transceivers, the plurality of transceivers being located within the broadcast range of the recipient transceiver, the method comprising the steps of:

(a)  transmitting a communication at a first power level such that only a first group of transceivers receive the broadcast, the communication including a command causing each of the first group of transceivers not to respond to a subsequent broadcast; and subsequent thereto

(b)  transmitting a communication at a second power level greater than the first power level such that a second group of transceivers greater than and including the first group of transceivers receive the broadcast, but such that only a limited number of transceivers of the second group respond to the broadcast, the limited number of transceivers excluding the first group of transceivers.

29.  A method for communicating to a recipient transceiver from a plurality of transceivers, the plurality of transceivers being located within the broadcast range of the recipient transceiver and the plurality of transceivers exceeding the number of transceivers from

34

which communications can be received by the transceiver without radio frequency interference due to its channel capacity, the method comprising the steps of:

(a) transmitting a communication at a first power level such that only a first group of transceivers receive the broadcast, the first group in number of transceivers being not greater than the number of transceivers from which communications can be received by the transceiver without radio frequency interference due to its channel capacity, the communication including a command causing each of the first group of transceivers not to respond to a subsequent broadcast; and subsequent thereto

(b) transmitting a communication at a second power level greater than the first power level such that a second group of transceivers greater than and including the first group of transceivers receive the broadcast, but such that only a limited number of transceivers of the second group respond to the broadcast, the limited number of transceivers excluding the first group of transceivers and comprising not greater the number of transceivers from which communications can be received by the transceiver without radio frequency interference due to its channel capacity.

30. The method of claim 29, wherein the recipient transceiver comprises an external network access transceiver.

31. The method of claim 29, wherein each of the plurality of transceivers comprises a transceiver attached to an asset to be tracked.

32. The method of claim 31, wherein the transceivers attached to the tracked assets comprise transponders.

33. The method of claim 31, wherein the transceivers attached to the tracked assets are semi-passive and the recipient transceiver is active.

34. The method of claim 29, wherein each of a first set of transceivers of the plurality of transceivers includes a first class designation and each of a second set of transceivers of the plurality of transceivers includes a second class designation different from the first class designation, and wherein each communication includes an identification of one of the class designations.

35. The method of claim 34, further comprising the step of assigning a class designation to each of the plurality of transceivers.

36. The method of claim 34, further comprising the step of filtering, by each transceiver of the plurality, communications from the recipient transceiver for an identification of its class designation within the communication.

37. The method of claim 36, further comprising ignoring, by each transceiver of the plurality, each communication if an identification of its class designation is not found therein.

38. The method of claim 34, wherein each of the plurality of transceivers comprises a transceiver attached to an asset to be tracked.

39.    The method of claim 38, wherein each class designation of the transceivers represents a common characteristic or behavior of the asset tracked thereby.

40.    A method of forming a wireless data communication network among a plurality of transceivers for tracking assets associated with the transceivers, comprising:

(a)    assigning a class designation to a population of transceivers based on a common characteristic or behavior of the assets associated with the transceivers;

(b)    selecting a primary transceiver from among the population of transceivers, the remainder of the population of transceivers being secondary transceivers; and

(c)    forming a class based hierarchical network among the population of transceivers, including:

(i)    broadcasting from the primary transceiver a primary availability signal including a primary class identifier representative of the class designation assigned to both the primary transceiver and the secondary transceivers,

(ii)    in response to the primary availability signal, transmitting from a responding one of the secondary transceivers a registration signal including a secondary transceiver identifier,

(iii)    storing at the primary transceiver the secondary transceiver identifier of the responding secondary transceiver, and

(iv)    repeating steps (ii) and (iii) for each of the secondary transceivers;

thereby facilitating class based communication with the population of transceivers.

41.    A method in accordance with claim 40, further comprising:

establishing a network link between an asset-tracking application and the primary transceiver;

receiving a message from the asset-tracking application at the primary transceiver, the message including one or more packets having a preamble that includes a target class identifier representing the class designation; and

retransmitting the message from the primary transceiver for receipt by the secondary transceivers.

42.    The method of claim 41, further comprising:

providing a network interface module (Gateway) in communication with the asset-tracking application; and

establishing a communication link between the Gateway and the primary transceiver based on the class designation of the primary transceiver, thereby enabling the asset-tracking application to communicate selectively with the population of transceivers based on its assigned class designation.

43.    The method of claim 40, in which assigning the class designation to the population of transceivers comprises the steps of, for each of the transceivers:

placing a plurality of radio frequency transponders (RFTs) in proximity to the transceiver, each of the RFTs including a preset class designation;

reading, at the transceiver, the preset class designations of at least a portion of the RFTs in proximity to said transceiver; and

assigning the class designation to the transceiver based on the preset class designations read by said transceiver.

44.    The method of claim 40, in which assigning the class designation to the population of transceivers comprises, for each of the transceivers:

providing an interrogator module including a interrogator interface and an interrogator transmission module;

manually activating the interrogator module via the interrogator interface, the interrogator transmission module responsive to the manual activation to send a configuration command to the transceiver, the configuration command including the class designation;

receiving the configuration command at the transceiver; and

assigning the class designation to the transceiver based on the configuration command received.

45.    The method of claim 44, wherein the interrogator module is provided in a communicator.

46.    The method of claim 45, wherein the communicator comprises a personal digital assistant (PDA).

47.    The method of claim 40, in which the forming of the class based hierarchical network includes promoting one of the secondary transceivers and propagating an additional hierarchical level of the network from the promoted secondary transceiver.

48.    The method of claim 40, further comprising:

assigning an abstracted class designation to a second population of transceivers, the abstracted class designation representing a common characteristic or behavior of the assets associated with the first and second populations of transceivers, the abstracted class designation being a meta-class of the class designation of the primary transceiver;

abstracting the class designation of the primary transceiver; and

establishing a network link between the primary transceiver and one or more of the second population of transceivers.

49.    The method of claim 40, in which the class designation includes a privilege level of the transceiver.

50.    An *ad hoc* class based network formation routine operable on a transceiver to automatically form with multiple peer transceivers the class based hierarchical network in accordance with the method of claim 40, in the absence of centralized control.

51.    An *ad hoc* network formed in accordance with the method of claim 40.

52.     The *ad hoc* network of claim 51, further comprising a network interface module (Gateway) in communication with the transceivers and an external computer network to facilitate communication between the transceivers and the external computer network.

53.     An asset-tracking system including the *ad hoc* network of claim 51 and a computer-operable asset-tracking application in communication with the *ad hoc* network for querying the transceivers of the *ad hoc* network.

54.     The asset-tracking system of claim 53, further comprising a handheld interrogator module adapted for operating the asset-tracking application, and for querying one or more of the transceivers of the *ad hoc* network, selectively, on the basis of the transceivers' class designations.

55.     A dynamic distributed hierarchical database system formed in accordance with the method of claim 40.

56.     The database system of claim 55, further comprising a computer-operable asset-tracking application for sending a class-directed database command to one or more of the transceivers, the class-directed database command including an address representative of the class designation, and in which each transceiver of the class based hierarchical network includes:

             a read/write memory for storing a profile representative of the class designation; and

             a handling routine for interpreting and responding to the class-directed database command received from the asset-tracking application.

57.     The database system of claim 56 in which:

             the class-directed database command includes a data query; and

             the handling routine of each transceiver includes a query handling routine for transmitting at least a portion of said transceiver's profile to the asset-tracking application in response to receipt of the data query.

58.     The database system of claim 56 in which:

             the class-directed database command includes a data update command; and

             the handling routine of each transceiver includes a data update routine for changing at least a portion of said transceiver's profile in the read/write memory, in response to receipt of the data update command.

59.     The database system of claim 56 in which the address of the class-directed database command includes a wildcard to thereby direct the class-directed database command to any subclasses of the class designation.

60.     A method of forming a wireless data communication network among a plurality of transceivers for tracking assets associated with the transceivers, comprising:

             assigning a first class designation to a first population of transceivers based on a first common characteristic or behavior of the assets associated with the first population of transceivers;

assigning a second class designation to a second population of transceivers based on a second common characteristic or behavior of the assets associated with the second population of transceivers; and

propagating a first and second class based hierarchical communication networks for transmitting data among the respective first and second populations of transceivers based on their respective class designations, the first hierarchical communication network including a first root primary transceiver, and the second hierarchical communication network including a second root primary transceiver.

61. The method of claim 60, in which:

the propagating of each of the first and second hierarchical class based communication networks includes operating at each transceiver a class based network formation (CBNF) routine, the CBNF routines of each of the first population of transceivers cooperating with the CBNF routines of at least some of the others of the first population of transceivers to thereby automatically form the network among the first population of transceivers, and the CBNF routines of each of the second population of transceivers cooperating with the CBNF routines of at least some of the others of the second population of transceivers to thereby automatically form the network among the second population of transceivers.

62. A method in accordance with claim 60, further comprising:

providing an asset-tracking application;

establishing a first network link between the asset-tracking application and the first root primary transceiver;

establishing a second network link between the asset-tracking application and the second root primary transceiver; and

selectively transmitting a message from the asset-tracking application to the first hierarchical network, the message including one or more packets having a preamble that includes a target class identifier representing the first class designation.

63. The method of claim 62, further comprising:

providing a network interface module (Gateway) in communication with the asset-tracking application;

establishing a first communication link between the Gateway and the first root primary transceiver, based on the first class designation; and

establishing a second communication link between the Gateway and the second root primary transceiver, thereby enabling the asset-tracking application to communicate selectively with the first and second populations of transceivers.

64. . The method of claim 60 in which assigning the first and second class designations to the respective first and second populations of transceivers comprises, for each of the transceivers:

placing a plurality of radio frequency transponders (RFTs) in proximity to the transceiver, each of the RFTs including a preset class designation; and

reading, at the transceiver, the preset class designations of at least a portion of the RFTs in proximity to said transceiver.

65. The method of claim 60 in which assigning the first and second class designations to the respective first and second populations of transceivers comprises, for each of the transceivers:

providing an interrogator module including a interrogator interface and an interrogator transmission module;

manually activating the interrogator module via the interrogator interface, the interrogator transmission module responsive to the manual activation to send a configuration command to the transceiver, the configuration command including one of the first and second class designations;

receiving the configuration command at the transceiver; and

assigning said one of the first and second class designations to the transceiver based on the configuration command received.

66. The method of claim 60 in which the forming of at least one of the first and second class based hierarchical communication networks includes promoting one of the transceivers and propagating an additional hierarchical level of the network from the promoted transceiver.

67. The method of claim 60 in which, the second class designation is an abstraction of the first class designation and represents a common characteristic or behavior of the assets associated with the first and second populations of transceivers, and further comprising:

abstracting the first class designation of the first root primary transceiver; and

establishing a network link between the first root primary transceiver and one or more of the second population of transceivers.

68. The method of claim 60 in which one or more of the first and second class designations includes a privilege level.

69. An *ad hoc* class based network formation routine operable on a transceiver to automatically form with multiple peer transceivers the first and second class based hierarchical networks in accordance with the method of claim 60, in the absence of centralized control.

70. An *ad hoc* network formed in accordance with the method of claim 60.

71. The *ad hoc* network of claim 70, further comprising a network interface module (Gateway) in communication with the first and second root primary transceivers and an external computer network to facilitate communication between the first and second class based hierarchical networks and the external computer network.

40

72.     An asset-tracking system including the *ad hoc* network of claim 70 and a computer-operable asset-tracking application in communication with the *ad hoc* network for querying the transceivers of the *ad hoc* network.

73.     The asset-tracking system of claim 72, further comprising a handheld interrogator module adapted for operating the asset-tracking application, and for querying one or more of the transceivers of the *ad hoc* network, selectively, on the basis of the transceivers' class designations.

74.     A dynamic distributed hierarchical database system formed in accordance with the method of claim 60

75.     The database system of claim 74, further comprising a computer-operable asset-tracking application for sending a class-directed database command to one or more of the transceivers, the class-directed database command including an address representative of ·a selected one of the first and second class designations, and in which each transceiver of the first and second class based hierarchical networks includes:

            a read/write memory for storing a profile representative of the transceiver's assigned class designation; and

            a handling routine for receiving, interpreting, and responding to class-directed database commands when the address of the class-directed database command corresponds to the transceiver's assigned class designation.

76.     The database system of claim 75 in which:

            the class-directed database command includes a data query; and

            the handling routine of each transceiver includes a query handling routine for transmitting at least a portion of said transceiver's profile to the asset-tracking application in response to receipt of the data query.

77.     The database system of claim 75 in which:

            the class-directed database command includes a data update command; and

            the handling routine of each transceiver includes a data update routine for changing at least a portion of said transceiver's profile in the read/write memory, in response to receipt of the data update command.

78.     The database system of claim 75 in which the address of the class-directed database command includes a wildcard, to thereby direct the class-directed database command to all subclasses of the selected one of the first and second class designations.

79.     A method of forming a hierarchical *ad hoc* network for use in tracking assets, comprising:

            identifying a first class of the assets having a first common characteristic or behavior;

            identifying a second class of the assets having a second common characteristic or behavior;

            associating a wireless transceiver with each of the assets of the first and second classes of assets, each of the wireless transceivers including a digital processor, a

41

memory, and a class based network formation (CBNF) routine operable on the digital processor;

selecting a first class designation representative of the first class of assets and a second class designation representative of the second class of assets;

5      storing a first class designation in the memories of each of the wireless transceivers associated with the first class of assets;

storing a second class designation in the memories of each of the wireless transceivers associated with the second class of assets; and

initiating the CBNF routines of the wireless transceivers to automatically

10     propagate, in the absence of central control, a first hierarchical *ad hoc* network among the wireless transceivers of the first class and a second hierarchical *ad hoc* network among the wireless transceivers of the second class, the first hierarchical network being automatically organized so that it is logically distinct from the second hierarchical network.

15    80.    The method of claim 79 in which the first class of assets includes a subclass of assets sharing a third common characteristic or behavior.

81.    A portable network device adapted for attachment to one of multiple peer assets having a common characteristic or behavior, comprising:

a wireless transceiver;

20           a digital information processor in communication with the wireless transceiver;

a power source for providing electrical power to the wireless transceiver and the digital information processor;

a memory unit in communication with the digital information processor, the memory unit adapted to store a class designation representative of the common

25    characteristic or behavior; and

a class based network formation (CBNF) routine operable on the digital information processor to form a network link selectively with one of multiple peer devices attached to other peer assets and including a peer designation representing the common characteristic or behavior of the peer assets, the CBNF routine operable to send network

30    organization messages including the class designation and to receive network organization requests from the peer devices, to thereby selectively propagate a class based hierarchical *ad hoc* network among the network device and the peer devices for tracking the peer assets.

82.    The device of claim 81 in which the memory unit is a read/write memory unit.

35    83.    A dynamic distributed hierarchical database system for asset tracking, comprising:

a plurality of computer units each associated with at least one asset having a characteristic or behavior represented by a class designation, each computer unit including:

(a)    a memory unit for storing a profile representative of the class designation;

42

(b)     an *ad hoc* class base network formation routine in communication with the memory for establishing a hierarchical network with other computer units based on the class designation; and

(c)     a query handling routine for interpreting and responding to database queries received from an asset-tracking application that correspond to the class designation.

84.     The database system of claim 83 in which the memory unit includes read/write memory.